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# SCIENCE

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## THE VALUE AND SERVICE OF ZOOLOGICAL SCIENCE<sup>1</sup>

### ESTHETICAL AND RECREATIONAL VALUES

WE are met together in a world convulsed by strife, resounding with the measured tramp of armies, with the clash of arms, and into the vortex of this world-wide conflict our own nation has been drawn. Back of the rising smoke of battle towers the gaunt figure of materialism. It is greed of material gain, it is lust of dominion, wherewith to reap this gain, that has precipitated this mighty struggle.

All nations have allowed themselves to fall in more or less degree under the sway of this materialism, and we ourselves are not without guilt in this respect, though not so guilty as our critics would fain have us believe. It was not to be wondered at that under these conditions many at first saw in this war only the rivalry of sordid interests, that they hesitated to take sides in a struggle in which they conceived the end not as the triumph of noble principles but as the supremacy of commercial advantage, that our critics charged us with seeking to serve only our own selfish interests and taxed us with hypocrisy when on entering the conflict we renounced material gain and raised the banner of truth and justice.

But exposed to the heat of this conflagration and in the crucible of suffering men's ambitions have been refined, the metal has been freed from the dross. As the struggle has progressed, another figure—the figure of idealism—has become defined, ris-

<sup>1</sup> Symposium before the American Society of Zoologists, Minneapolis, December 29, 1917.

ing youthful, strong and virile, and the meaning of the conflict stands plainly revealed. It is the age-long struggle between the multitude and the privileged few, between the rights of the people and the divine right of kings, between the conception of government which makes the state the servant of the people who have created it and that which reduces them to slaves and places not only their possessions but their lives, at the disposal of the divinely appointed rulers of the state, and even demands that their consciences be subservient to the will of the sovereign. Gradually as the issue has defined itself more and more clearly, the logic of events has forced nations whose entrance into the struggle may have been in a degree dictated by other and less noble motives to commit themselves definitely and unmistakably with respect to these fundamental principles and the sympathy of the individual must be bestowed for or against the democracy in which we who are truly Americans all believe.

But so confused and so clouded have been the issues, so bitter the struggle, waged both with the pen and the sword, that some have doubted the value of art, of literature, of science, of religion, and even of civilization itself. Ingenious logic has lent itself to so interpret and apply the principles of our *own* science as to justify the theory that might makes right, that the weak have no rights which the powerful can be bound to respect, that the strong nation is justified in taking possession of and administering the heritage of its weaker neighbors even though it be necessary to exterminate the weaker in so doing.

The conflict has been severe. The forces of might, better prepared, better organized, more effectively administered, and profiting also by advantages of strategic position, have seemed to be on the high road to success. The issue still hangs in the bal-

ance, and victory for the right is not yet assured. Therefore, there are those who, faint-hearted, have despaired and, blinded by the apparent success of might, have lost faith in right and have recanted, laying the blame upon the idealists for having led them astray. They now profess admiration for the strength of materialism and decry the weakness of an idealism which breeds a race of cowards and weaklings. But are they justified? While it is true that idealism, uncontrolled by reason, may build a house of cards which in time of stress collapses and buries both its followers and those associated with them, can this be affirmed of that idealism through which shines the clear light of reason? Though the believer in truth, justice and right hesitates to draw the sword, is he not the stronger, relatively, if when he does so, he enters the conflict with clear conscience and high resolve? One looks in vain through the history of the ages for a case where freemen have been lacking in the courage to uphold their convictions, even in the face of the most oppressive opposition, or to defend them, if necessary, by force of arms.

It is this spirit of idealism which led our nation at first to give generously and individuals to sacrifice much that the sufferings of war might be mitigated, and which, though we were long forbearing, led us, when reason had shown clearly the necessity of so doing, to enter the conflict, actuated by motives more altruistic than those which have impelled any nation in the previous history of this world. It is idealism that is leading our young men willingly into a crusade which takes them far across the sea, to endure privations, suffering and death itself, while their loved ones, who have bid them "God-speed" with tears in their eyes but with the pride of sacrifice in their hearts, pray for their success, and

hope for their return. Materialism is strong, but idealism, stronger still, is the most powerful force in the world to-day. We can not doubt the outcome of the struggle, with our tremendous resources added to those of the nations with whom we are associated, and with the consciousness of high moral purpose to animate our armies.

Not only is idealism a force to be reckoned with now but from it we draw our faith in the future. When the nations come around the conference table to adjust terms of peace, the promise of the future will rest in the degree to which idealism is able to sway the council. Should materialism, perchance, assert itself, only a truce is possible. The evolution of justice as between man and man can be slowed and even stayed for a time, but can not be long arrested.

If then so much depends upon this force, if in it rests our faith in the present and our hope in the future, we should do well to investigate fully its nature and to determine as precisely as possible the factors that contribute to its development. Such a pursuit, however, does not lie within the limits of this discussion; it is appropriate only to raise the question whether a love for the beautiful and the cultivation of it—that is, esthetics and esthetic training—are not among such factors.

Idealism in last analysis rests upon a keen perception of truth, right and justice, and this involves that which is esthetic as well as that which is ethical. A recent writer on esthetics<sup>2</sup> says that

esthetic and moral judgments are to be classed together in contrast to judgments intellectual. . . . Esthetic judgments are mainly positive, that is, perceptions of good, moral judgments are mainly and fundamentally negative, or perceptions of evil. . . . Esthetics deals with values which are imme-

diate, moral values are always remote. . . . Not only are the various satisfactions which morals are meant to secure esthetic in the last analysis, but when the conscience is formed and right principles acquire an immediate authority, our attitude to these principles becomes esthetic also. Honor, truthfulness and cleanliness are obvious examples.

Esthetic perception should not be confused with artistic production, although esthetic desire is back of and tinges all art. Thus interpreted art is subjective, esthetics objective. The study of animal life has been a source of inspiration to artists of all time and apparently the earliest beginnings of decorative art consisted in the crude drawings of men and animals traced by cave men on the walls of the caverns which sheltered them. Many conventional designs when traced back through the successive steps which mark their evolution lead to representation of animals which because of some peculiarity of form excited the imaginations of aboriginal man. But we are not concerned directly with the value of animal study or the services of such study to art, great as they have been. It is the appeal which the study of animal forms makes to our sense of the beautiful that interests us here.

In order to appreciate beauty, estheticians tell us, we must put ourselves in the place of that which excites the sensation, in a certain sense project ourselves into it. And as we do so "our motor activities rehearse the tensions, pressures, thrusts, resistances, efforts, the volition, in fact the life, with its accompanying emotions, which we project into the form and attribute to it."<sup>3</sup> Thus the sensation of beauty is a motor as well as a sensory phenomenon. If this sensation is one of pleasure we ascribe to the object the possession of beauty, if the opposite, of ugliness. But all sensations of

<sup>2</sup> Santayana, "The Sense of Beauty" (1910), pp. 23 et seq.

<sup>3</sup> Lee and Anstruther-Thompson, "Beauty and Ugliness" (1912), p. 28.

pleasure are not accompanied by the perception of beauty. Pleasant as our recollections of a certain dinner may be we would hardly refer to it as beautiful, even to compliment the most gracious hostess. The frequent repetition of esthetic experience gradually develops in the individual a greater susceptibility to such stimulation, in which regard esthetic pleasure differs from other pleasures the frequent indulgence in which leads to satiety and even repulsion.

This ability to project ourselves, which with respect to other creatures, leads to that we call sympathy, is a most valuable acquirement. It needs no argument to prove that it tends to develop unselfishness, humanitarianism, and ultimately a love of truth, right and justice, which is idealism. The cultivation of esthetics, therefore, is clearly not only *one* factor in the production of idealism, but perhaps the most important factor of all.

If one compare his impression with regard to a beautiful object with that of others he soon learns that the impression of each person is different, depending on previous experience, training and point of view, and that perceptions of beauty are always individualistic. The perceptions of two individuals may approximate one another if the basis of the one approximate that of the other, but as each has his own personality so each has his own perceptions of beauty. If one be honest with himself and others this tends to develop a respect for others' opinions and his sense of fellowship with the rest of mankind.

To quote again from a text referred to above:<sup>4</sup>

It would be an error to suppose that esthetic principles apply only to our judgments of works of art or of those natural objects which we attend to chiefly on account of their beauty. . . . In the

<sup>4</sup> Santayana, *l. c.*, p. 110.

leading political and moral idea of our time, in the idea of democracy, I think there is a strong esthetic ingredient, and the power of the idea of democracy over the imagination is an illustration of the effect of multiplicity in uniformity. . . . Of course, nothing could be more absurd than to suggest that the French Revolution . . . had an esthetic preference for its basis; it sprang, as we know, from the hatred of oppression, the rivalry of classes, and the aspiration after a freer social and strictly moral organization. But when these moral forces were suggesting and partly realizing the democratic idea, this idea was necessarily vividly present to men's thoughts; the picture of human life which it presented was becoming familiar, and was being made the sanction and goal of constant endeavor. . . . The consequence was that democracy, prized at first as a means to happiness and as an instrument of good government, was acquiring an intrinsic value; it was beginning to seem good in itself, in fact the only intrinsically right and perfect arrangement. A utilitarian scheme was receiving an esthetic consecration. The practical value of the arrangement on which, of course, it is entirely dependent for its origin and authority, was forgotten, and men were ready to sacrifice their welfare to their sense of propriety; that is they allowed an esthetic good to outweigh a practical one.

It was becoming an ideal.

Esthetic love of uniformity, however, is usually disguised under some moral label; we call it the love of justice, perhaps because we have not considered that the value of justice also, in so far as it is not derivative and utilitarian, must be intrinsic, or what is practically the same thing, esthetic.

The same author emphasizes the idea that beauty is a species of value and the philosophy of beauty a theory of values. If this be true then another value of esthetic training is that it educates the judgment. One is inevitably led to compare beautiful objects one with another not only to determine degrees of beauty, but also to discover the new beauty which such comparison may disclose.

The pursuit of beauty, furthermore, involves continued attention; a certain object may attract us at first glance because it exerts a powerful stimulus and commands

our attention, but no casual glance will reveal beauty in it, and to appreciate that beauty to the utmost we must become absorbed in contemplation, must, as we often say, "enter fully into the spirit of the thing." This is another value attached to the study of esthetics, that it develops the power of concentrated observation.

It thus appears that the cultivation of esthetics not only tends to develop sympathy and from that as a starting-point, becomes a prominent factor in the development of idealism, but also develops judgment, power of concentrated observation, and respect for the opinions of others, being thus also a factor in the production and spread of democratic ideals. The multiplication of objects of beauty in our cities —parks, with all that usually goes with them, fine buildings, and works of art—is not extravagance, nor is it of little consequence that we seek to secure beauty in all the details of our surroundings. The effect of these things, acting gradually and exerted unconsciously upon the citizens, produces in time results which no one can measure but of the value of which there can be not the slightest doubt.

In this connection we should be reminded of the fact that esthetics is but rarely taught as such, and indeed, the daily contact with beautiful things, working silently but none the less surely, is more effective than conscious efforts to secure results, which too often defeat themselves by the opposition of the persons whom it is desired to affect. Esthetic training may be secured from the study of literature, of science, or of the arts, if care be used to take advantage of the opportunities constantly offered.

The study of animal life is peculiarly suited to form the basis of esthetic training, and, indeed, no one can acquire even a rudimentary knowledge of zoology without be-

ing influenced esthetically. There is in the case of the animal, not only the beauty of form and of color which belongs to so many natural objects, but also the beauty of motion, in the case of birds the beauty of song, and in all higher animals even greater esthetic possibilities are revealed in the degree to which their natures are akin to that of man. Animal nature study develops sympathy, judgment and the power of observation, and always excites the closest attention, thus possessing exactly the esthetical values referred to above. It is clearly opposed to all that is dogmatic, and properly presented or acquired contributes to liberality of thought and respect for the points of view of others.

In another way animal nature study is supreme among the subjects which may form the basis of training in esthetics. Just as the earliest artistic efforts of primitive man seem to show that of all the objects about him animals appear to have most attracted his attention and stimulated first his imagination, so in childhood we today are first most strongly impressed by the living animals about us. While children may be to a degree interested in trees, and flowers, and the inanimate things around them, the most effective approach to nature study in the case of younger children is through the study of animals and this is the logical beginning of esthetic training.

It thus appears, if the points which have been referred to are well taken, that the cultivation of esthetics is highly valuable to us as individuals, to the communities in which we live, to the nation of which we are a part, and to mankind as a whole, and since the study of animal life is preeminently fitted to serve as the beginning of such cultivation and is peculiarly appropriate as material for its continued prosecu-

tion, no further argument is necessary to show the esthetical value of zoology.

In inviting your attention to the other aspect of the topic assigned to me, the recreational value of zoology, it should first be noted that this does not involve entrance upon a new field. The play instinct, which is exhibited by many animals in varying degree, and which with his more complex nervous system, reaches its highest and most varied manifestations in man, is essentially an esthetic instinct.

This is most evident in the play of children. They impersonate various characters, and little girls, "playing lady" reproduce practically all the activities of their mothers—they keep house, they have and direct imaginary servants, they order by telephone articles needed in the household, they make calls, go to parties, become ill and call physicians or nurse members of the families who are sick, they go visiting, write, send and receive letters, imagine themselves afflicted by the various trials that beset married life, exchanging sympathy with one another over these troubles, and if they be not yet subject to these trials, they have lovers and enjoy the consequent notes, flowers, bonbons, invitations to the theater, and other attentions that attend such a blissful state of existence. Boys in like manner impersonate their fathers, or conceive of themselves as animals the habits of which they imitate, and even pose as inanimate objects and endeavor to reproduce the qualities they ascribe to such objects. Have none of you a memory of having played animal and a recollection of the disappointment you felt as an elephant when your more sagacious companions, who were monkeys, climbed the tree after apples and insisted on your remaining on the ground?

Thus the child puts himself in the place of the object which he sees in his imagina-

tion, and derives pleasure from the activities that that involves. That he secures from it a sensation of beauty may be questioned in many cases, but it should be remembered that children reproduce more or less perfectly such activities as seem to them attractive, such as flying and swimming, or personal qualities which they admire, that they aim to arrive at consistency in their play, and that a sense of rhythm is frequently strongly evident. Many games are accompanied by singing, and a careful study of the whole matter has led to a general recognition among estheticians of the esthetical nature of play as it is carried on by children.

In adults this is less clear. But the essence of play in adults is in the laying aside of one's ordinary character and activities and the assumption of a different character with the different activities this involves. To a greater degree than in the case of children do adults seek to realize the fullest consistency in the playing of the part and to a greater degree do these activities involve that which is really beautiful. It is interesting to note also the tendency of adults at play to break into song.

Play activities must, if they be in the fullest sense of the word play, have nothing in common with our ordinary vocations. Hunting is recreation to the business man but business to the professional hunter and guide. A hunter would enjoy less of the pleasure of the hunt if he did not wear the regulation hunting clothes and carry the paraphernalia which is appropriate to such an expedition. The charm in hunting lies in the constant stimulation of the imagination. The hunter is alert to the possibility that any moment the game may come into view and demand instant action if it be secured. Any grass-clump, any thicket, any piece of woodland, any depression, or any turn in his course may disclose

the quarry. A hunting excursion is really a constant succession of play-reactions. The killing is not pleasure, but the getting of the game gives satisfaction because it is the culmination and realization of a pursuit which has been in the fullest sense of the word, esthetic.

Not only must play activities be different from ordinary activities but the object sought must be non-utilitarian. A man who goes hunting or fishing with the sole idea of killing and bringing home all the booty he can, and, it may be, whose game is driven up to him, does not derive the recreation he might from his quest.

It is unnecessary to say that recreation must afford pleasure to him who seeks it. This element introduces the possibility of infinite variety in play, and again emphasizes its resemblance to other esthetic activities, which we have seen are individualistic in character. Two persons will find equal enjoyment in very different types of recreation, what is play to one might be the hardest of work to another, and the ways in which different individuals will pursue the same type of recreation are almost as many in number as are the individuals themselves.

The aim of play is primarily rest. We endeavor to select recreation of such a character as to demand the use of muscles ordinarily not called into activity, thus relieving those that are exhausted with the daily toil. We seek enjoyment in directions that carry us outside our ordinary field of thought and in that way afford the opportunity to tired nerve cells to recuperate their energies. We demand in our play freedom from worry and responsibility. A quality in play much emphasized by some students of the subject is that its activities are assumed voluntarily and may at any moment be suspended. How much it adds to the enjoyment of a trip if we feel that it

makes no difference when we get home! Play should involve both muscular and nervous activity and should be capable of fully absorbing the attention of the player.

Finally it may be pointed out that recreation should be taken away from the familiar surroundings, is most profitable when taken in the open air, and most satisfying to a person of taste and culture, if sought amid scenes which stimulate our sense of beauty.

The ultimate aim of recreation is, as was that of esthetics, the development of a more effective individual to the ends that he may become a more worthy citizen. As each develops sympathy, the power of judgment, and of concentrated attention, they both do contribute definitely to this end. And both assist in this development in another manner which has not been mentioned. Nervous balance, the ability of an individual to maintain a clear mental vision, an active imagination, the possession of strong emotions always held in check by reason, are necessary if a man is going to be consistently a safe and progressive citizen. Both esthetics and nature study not only tend to develop this balance and these qualities, but both also offer relief from strain when one's burdens become heavy and the weight of responsibility presses hard. One person finds relief in the beauty of art, another in the beauty of literature, but many and perhaps the majority seek it in the beauty of nature in one form or another or in the relaxation and recuperation which are afforded by recreation.

That the study of animals, particularly in their natural environment, affords opportunities for recreation is so evident as to make proof unnecessary. But emphasis is given to the statement if attention is called to the fact that all the essential conditions of play are present, that it takes one away from ordinary scenes and activi-

ties, leads him into the open air, brings him in contact with interesting and beautiful objects, demands physical and mental activity, and if he be susceptible to the attraction of such objects at all, absorbs his attention, and thus relieves him from worry and responsibility.

Thus zoology has a very considerable recreational value, but it is clear from what has been said that this is to be secured in greatest degree from the study of field zoology, or as it is usually called, nature study. There is much esthetic value in the study of animals in the laboratory and museum and there is some recreational value as well, but both are realized in far greater degree if animals be studied living, in their natural surroundings, and displaying their characteristic activities.

Hunting is attractive to many men and to some women, but opportunities for such recreation are rapidly growing less and less, and over the larger part of our country are now secured only at a considerable sacrifice of time and money. Fishing is still within the reach of a larger number, but opportunities for this enjoyment are constantly diminishing. Under these conditions many sportsmen have taken to the camera and find close at hand in the pursuit and photography of animals too small to serve as game all the pleasures that they formerly found in hunting or fishing.

One feature of nature study which adds greatly to its recreational value so far as the great number of our people is concerned is that it may be pursued close at hand. The out-of-doors is all around us, but most of us see little of it. Let one take up the pursuit of nature study and everything about him takes on a different aspect. Where before he saw only earth and sky and woods and fields, now he sees a myriad of beautiful and interesting forms. His

eyes are opened to objects and activities before undreamed of and not only does the thicket and weed-patch, pond and stream, become scenes of marvelous activity, but the air is vibrant with tones before unheeded. The activities of the animals here as in the case of esthetics give to animal nature study a peculiar value as compared with the study of plants or inanimate nature.

And as the study is pursued the surroundings become pregnant with more and more of interest and beauty. Every walk becomes an adventure and every area to which one devotes his attention a field of discovery. It has been said that to secure the greatest value from recreation one must seek new scenes and such as afford opportunities for the contemplation of the beauties of nature. To the student of nature study the most familiar scenes take on a new aspect, and as his knowledge increases he not only learns how to find new and beautiful objects, but he acquires also that which enables him to project himself into features of his surroundings which before seemed commonplace and uninteresting. These now appear beautiful and to opportunities for healthy recreation are added means of esthetic enjoyment which can be but slightly appreciated by those who have never experienced them. Nay more—as nature is infinite, and as he is capable of continued development, a lifetime of ever-widening opportunity unfolds itself as he proceeds.

It may seem a far cry from the tumult of battle to the calm and peace of the roadside, the meadow and the woods; from the broad principles for which nations are contending to the simple facts of nature study; from a field of struggle which involves the whole world to the area limited by one's horizon. But a little consideration shows

that it is not so far, after all. From the highways and byways from one end of this country to the other are coming the men who are to fight the battle for freedom; in last analysis the idealism for which this nation stands is rooted in the minds of its people; and the extent to which the government can prosecute the war, it may be even victory itself, depends upon the strength of that idealism in the minds of even the most humble and least traveled of our citizens.

But after the war will come peace, when we will resume to a large degree our former daily habits of life and thought, when the communities in which we live will once more take up the tasks of civic and industrial development, when our nation will turn again to those problems of government and society upon the successful solution of which its future prosperity, if not its existence, depends. Then will be needed more than now the idealism which a crisis like the present calls forth in such strength, but which slumbers in time of peace; then will we need to consider most seriously the means by which that idealism may be developed and kept active. Then will democracy even more than at the present time need to be fostered and will we need to make use of every agency which will educate people to a broader view of their responsibilities and increase sympathy, the love of truth, right and justice, regard for the welfare of others, and a feeling of kinship with all mankind. And if the study of animal life can contribute even in a small degree to the effectiveness of our people and to the development of that idealism upon which the future of democracy depends, then is it worthy of consideration and the value of zoological science has one more claim to recognition.

R. H. WOLCOTT

UNIVERSITY OF NEBRASKA

#### SCIENTIFIC EVENTS

##### TIN IN VIRGINIA

THE United States is almost entirely dependent on foreign countries for its supply of tin. As this metal is a war-time necessity, and as a domestic source of supply is urgently needed, all known deposits of tin ore (cassiterite) in the United States have recently been examined by geologists of the United States Geological Survey, Department of the Interior. One of the most promising of these deposits is in the Irish Creek district, in the eastern part of Rockbridge County, Va., near the summit of the Blue Ridge. This deposit was recently examined by H. G. Ferguson, of the United States Geological Survey, which in this research is acting in cooperation with the Virginia Geological Survey. The existence of tin ore in the Irish Creek district has been known for many years, and between 1883 and 1893 the deposit there was actively mined. The mining company, however, became involved in litigation as to land titles and abandoned work in 1893. Work on the deposit was never resumed, and the old workings are now caved and heavily overgrown with brush, so that a thorough examination of them is difficult, but what Mr. Ferguson saw in the field and the information he derived from old reports led him to conclude that the deposits along the Blue Ridge in this vicinity offer some promise as a source of tin, both through the systematic working of the known veins and the possible discovery of other deposits. The cassiterite occurs in quartz veins that cut a granitic rock of peculiar appearance known as a hypersthene granodiorite. The veins do not continue for long distances and their content of tin is probably very irregular from place to place. Some high-grade ore was found, however, and some tungsten ore occurs with the cassiterite. It is believed that the district is worthy of further investigation. A copy of the report may be secured on application to Dr. Thomas Leonard Watson, director, Virginia Geological Survey, Charlottesville, Va.

##### INTERNATIONAL SCIENTIFIC NOMENCLATURE<sup>1</sup>

IN the *Comptes rendus* of the Paris Acad-

<sup>1</sup> From *Nature*.

emy of Sciences for February 11 there is a manifesto in the form of a memorandum entitled "Observations on Modern Scientific Language" by a number of French men of science, MM. Bigourdan, Blondel, Bouvier, Branly, Douvillé, Guignard, Haller, Haug, Henneguy, Lacroix, Lallemand, Laveran, Lecomte, Lecornu, Lemoine, Maquenne, Emile Picard, Roux, Schloessing, jun., and Tisserand. The writers of this note enter a protest against a tendency they have observed on the part of the younger generation of scientific workers both to neglect literary form in their publications and to introduce new and strange words which are often unnecessary or badly constructed.

It is suggested that youthful authors may perhaps think that the use of outlandish expressions lends an air of learning to their communications, whereas the impression sometimes produced upon the reader is that he has come upon a bad translation of a work originally published in some foreign language.

It is pointed out that, owing to the international character of science, words and expressions which are quite appropriate in one language have been transferred bodily into another language without proper steps having been taken to adapt them to their new home. For example, our words "control" and "to control" have been translated "contrôle" and "contrôler." But "contrôler" means "to register," and, therefore, ought not to be used in the sense of "to regulate" or "to exercise an influence over." The English expression "self-induction" sometimes appears in French papers on electricity in the shortened form of "le self." Even an Englishman would find it difficult to discover the meaning of such an expression, so that a Frenchman may be pardoned if he finds it barbarous.

The writers of the note express the hope that the more closely the bonds between the Allied nations are drawn, the more care may be taken in translating scientific terms and expressions. It is suggested that international congresses and all forms of international cooperation afford a means of "controlling" the international language of science.

#### APPLIED PSYCHOLOGY AT THE CARNEGIE INSTITUTE OF TECHNOLOGY AND ITS WAR-TIME WORK

DR. GUY M. WHIPPLE has resigned from the University of Illinois to accept appointment at the Carnegie Institute of Technology as professor of applied psychology and director of educational research. During the present year, Dr. Whipple has been in Pittsburgh part time as acting director of the Bureau of Salesmanship Research during the absence of Dr. Walter Dill Scott, who since last July has been in Washington as director of the Committee on Classification of Personnel in the Army. Dr. Whipple will continue as acting director of the Bureau of Salesmanship Research as long as Dr. Scott is engaged in war work. He will then enter on his duties as director of educational research and will carry forward scientific studies in engineering and technical education as they arise in the administration of instruction at the Carnegie Institute of Technology.

Announcement is made of the promotion to the rank of associate professor of Dr. James Burt Miner, who is acting as head of the division of applied psychology at the Carnegie Institute of Technology during the absence of Dr. W. V. Bingham on war work in Washington. Dr. L. L. Thurstone has been advanced to the rank of assistant professor. Dr. A. J. Beatty, assistant to the director of the Carnegie Bureau of Salesmanship Research, will on June 1 become director of education of the American Rolling Mills Company, at Marietta, Ohio. Dr. Kate Gordon has been granted leave of absence from the Carnegie Institute of Technology for the fall quarter to enable her to carry out for the California State Board of Control a psychological investigation of children who are wards of the state.

Dr. Beardsley Ruml has been given leave of absence from the Carnegie Institute of Technology to devote his full time to the direction of the work of the Trade Test Standardization Division of the Committee on Classification of Personnel in the Army. Dr. L. L. Thurstone has been granted half-time leave for similar work. Dr. T. J. Kirby has been granted

half-time leave from the University of Pittsburgh and is working with Dr. Thurstone, Mr. L. C. Toops, of the University of Ohio, and Dr. J. Crosbey Chapman, who is in charge of the Pittsburgh station of this Trade Test Standardization Committee. The purpose of these standardized trade tests is not to discover which trade or occupation a soldier should be trained to follow. It is rather to measure the degree of trade skill which his industrial experience has already given him. The question is not one of "guidance" but of assignment of men to those duties of a technical sort which their civilian occupations have already equipped them to follow to advantage in the Army. Oral and performance tests of carpenters, pattern makers, vulcanizers, automobile engine repairmen, truck drivers, electricians, etc., have been developed, standardized and introduced into Army procedure. Tests for skill in more than a hundred other trades of importance in a modern army remain to be developed and standardized. About twenty mechanical engineers, civil service experts, employment managers and psychologists are engaged in the preparation and standardization of these trade tests, working under the immediate supervision of Dr. Rumel, at Newark, New Jersey, and under the more general direction of Dr. Bingham who is executive secretary of the Committee on Classification of Personnel in the Army, with headquarters in the office of the Adjutant General at Washington. Installation of the trade tests in the Army camps is in charge of Mr. E. M. Hopkins, employment director of the General Electric Company.

#### PRESENTATION OF THE EDISON MEDAL

ACCORDING to the account in the *Electrical World* a large audience, gathered in the Engineering Societies Building, New York, at the annual meeting of the American Institute of Electrical Engineers on May 17, witnessed the presentation of the eighth Edison medal to Colonel John J. Carty of the United States Army Signal Corps, chief engineer of the American Telephone & Telegraph Company. The award of the medal to Colonel Carty for

his work in the science and art of telephone engineering has already been announced in SCIENCE. Those to whom the medal has been awarded in previous years are Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell and Nikola Tesla.

Dr. A. E. Kennelly, professor of electrical engineering at Harvard University and Massachusetts Institute of Technology, told of the history and significance of the medal. Dr. Michael I. Pupin of Columbia University said: "Carty's life is filled with romance. He never went to college. At the age of eighteen, when other boys entered college, he entered the service of the American Bell Telephone Company and at the age of twenty-eight became chief engineer of the great New York Telephone Company." E. W. Rice, Jr., president of the Institute, made the formal presentation of the medal. In accepting the medal Colonel Carty gave credit for the American telephone achievements to the engineers who have been associated with him in the Bell system and paid a tribute to Major-General George O. Squier, chief signal officer of the United States Army.

The newly elected Institute officers, who serve during the administrative year beginning on August 1, 1918, were the directors' nominees, as follows:

*President*—Professor Comfort A. Adams, Harvard University and Massachusetts Institute of Technology, Cambridge, Mass.

*Vice-presidents*—Allen H. Babcock, San Francisco; William B. Jackson, Chicago; Raymond S. Kelsch, Montreal; F. B. Jewett, New York; Harold Pender, Philadelphia; John B. Taylor, Schenectady, N. Y.

*Managers*—G. Faccioli, Pittsfield, Mass.; Frank D. Newbury, Pittsburgh; Walter I. Slichter, New York.

*Treasurer*—George A. Hamilton, Elizabeth, N. J.

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#### SCIENTIFIC NOTES AND NEWS

At the ninety-fourth annual commencement of the Rensselaer Polytechnic Institute, the degree of doctor of engineering was given to Lieutenant Colonel Henry W. Hodge, U. S. engineer, manager of roads, American Expe-

dictionary Force in France; to Alexander C. Humphreys, president of the Stevens Institute of Technology; to Edwin W. Rice, Jr., president of the General Electric Co.; to William Hubert Burr, professor emeritus of Columbia University, and to Onward Bates, of Chicago. The degree of master of civil engineering was conferred on Francis E. House, president of the Duluth & Iron Range Railroad.

AT the commencement of Colgate University the honorary degree of doctor of science was conferred on Professor Clarence A. Martin, dean of the college of architecture of Cornell University.

HARRY LEE HUBER, formerly pathologist in the University of Chicago, was awarded the Ricketts Prize on May 2, on account of his research work to determine new methods of treating tuberculosis. The prize consists of the income of \$5,000 and is given in memory of the late Dr. Howard Taylor Ricketts.

MR. F. E. KEMPTON, who receives his doctorate in plant pathology at the University of Illinois, this spring, has been appointed as pathologist to the Porto Rican Agricultural Experiment Station. He will leave for Porto Rico at once, where his address will be Mayagüez.

PROFESSOR JAMES H. BONNER, of the faculty of the school of forestry at the State University of Montana, has completed his training at Camp Lee, Virginia, where he received a commission as captain in the engineering corps.

MR. JOHN H. CARD, teacher of chemistry at the high school, Brockton, Mass., has joined the Chemical Service Section of the National Army. He has been assigned to the offensive research investigations at the American University Experiment Station, Washington, D. C.

DR. BENJAMIN T. TERRY has resigned his place as director of the Brooklyn laboratories of pathology of the Charities Department. He is reported to have said that he was not a politician, but a teacher, and conditions had become such that he thought it better to resign.

IRA A. WILLIAMS, formerly with the Iowa Geological Survey, and for the past five years ceramist and geologist for the Oregon Bureau of Mines and Geology, has asked to be relieved from his duties in connection with the bureau for the present field season in order to take charge of the development of large ranch interests in the Sacramento valley of California. Mr. Williams also relinquishes the professorship of ceramic engineering in the Oregon School of Mines at Corvallis at the close of the present college year.

PROFESSOR C. H. EIGENMANN, of Indiana University, has resigned as curator of ichthyology in the Carnegie Museum, the resignation to take effect on June 1.

PROFESSOR ERNEST HAECKEL, the distinguished German zoologist and exponent of the Darwinian theory, is reported by the German newspapers to be in failing health. On his eighty-fourth birthday, he is said to have sent to his friends an engraved birthday card, bidding them farewell.

THE University of Pennsylvania Museum has dispatched an expedition to South America under the leadership of Mr. Theodoor de Booy, assistant curator in the American Section of the museum, to explore the Sierra Pareja range of mountains in Venezuela not far from Lake Maracaibo. This high range of mountains which juts into Colombia is unexplored and the character of its natives unknown.

THE station at Green River, Wyoming, for the observation of the total eclipse of June 8 by the party from the Yerkes Observatory, University of Chicago, has been named "Camp Charles A. Young," in honor of the eminent American spectroscopist of solar eclipses. The program of observations to be undertaken includes: Direct photography of the corona with 60-foot coelostat and with 12-inch equatorial telescopes; spectroscopic investigation of the flash spectrum, in the infra-red with a small concave grating, and in the violet with camera using a "movie" film for quick succession exposures; photography of the coronal spectrum with prismatic cameras and with a slit-spectro-

scope; photometric work both visual and photographic; a photographic record of the successive stages of the eclipse with a "movie" machine provided with a "Euryscope" doublet lens of 25 inches focal length. The scientific staff at the station on May 20, were Messrs. Frost, Barnard, Parkhurst, Barrett and Miss Calvert. By June 3, others participating in the work will include Miss Lowater, of Wellesley College, Miss Wickham, Mrs. Parkhurst and Mr. Blakslee, of Yerkes Observatory. Dr. George S. Isham, of Chicago, and Professor C. C. Crump, of Ohio Wesleyan University and L. A. H. Warren, of Winnipeg. Weather conditions are now promising fairly at the station. The station from the Mount Wilson Solar Observatory is being established about a thousand feet from Camp Charles A. Young, which is situated under the buttes at the outskirts of the town of Green River on the main line of the Union Pacific Railroad.

FREDERICK REMSEN HUTTON, honorary secretary of the United Engineering Society and long dean of the faculty of engineering at Columbia University, has died in his sixty-fifth year.

ALONZO COLLIN, Sc.D., died in his eighty-second year on April 16. Dr. Collin was a graduate of Wesleyan University in 1858, and served Cornell College from 1860 until 1906, when he was made professor emeritus, retiring upon the Carnegie Foundation. His first chair was that of the natural sciences and later physics.

THE seventh lecture of the series on science in relation to the war was delivered at a joint meeting of the Washington Academy of Sciences and the Chemical Society on May 15, by Dr. Arthur A. Noyes, professor of theoretical chemistry at the Massachusetts Institute of Technology, and chairman of the Nitrate Committee. The subject of the lecture was "The nitrogen problem in relation to the war."

A SPECIAL meeting of the Engineering Foundation was held on May 28 in the auditorium of the Engineering Societies Building in New York. Dr. George E. Hale addressed the meeting on the "National Research Council."

The foundation is composed of representatives of the national societies of Civil, Mining, Mechanical and Electrical Engineers.

PROFESSOR COMFORT A. ADAMS, president of the American Institute of Electrical Engineers, and professor of electrical engineering at the Massachusetts Institute of Technology, was the main speaker at the annual meeting and dinner of the Schenectady Section of the institute on May 24.

THE address of Mr. William H. Babcock as retiring president of the Anthropological Society of Washington was delivered on April 23 and entitled "Some ethnological and national factors in the present war."

PROFESSOR ROBERT M. OGDEN, of Cornell University, delivered the commencement address at the University of Tennessee on May 29.

PROFESSOR WILLIAM T. SEDGWICK, of the Massachusetts Institute of Technology, delivered the commencement address at the Boston School of Physical Education on May 23.

THE annual spring meeting of the Eastern Association of Physics Teachers was held in the Salisbury laboratories of the Worcester Polytechnic Institute on May 25. Among the speakers at the meeting were Dr. Samuel J. Plimpton, instructor in physics, Worcester Polytechnic Institute; Clarence D. Kingsley, of the State Board of Education, and Dr. Gordon Webster, professor of physics at Clark University and a member of the Naval Consulting Board.

THE thirty-fifth annual meeting of the American Climatological and Clinical Association will be held in Boston on June 5 and 6, under the presidency of Captain J. Elliott, C.A.M.C., Toronto, Ont. The session of the association will be held at the Boston Medical Library, the Fenway.

THE annual joint conference of the United States Public Health Service with state and territorial health officers, will be held in Washington, June 3 and 4. The *Journal of the American Medical Association* states that the sanitation of extracantonment areas will be one of the chief subjects on the program. Reports will be made as to the success of the

cooperative arrangement developed during the past year for preventing the interchange of disease between civil and military populations. Among the subjects to be discussed are the relation to public health of industrial hygiene and sanitation, especially in war industries; the care of the health of tuberculous soldiers on their return to civil life; the use of records of drafted men for public health purposes; effects on the public health of the forthcoming shortage in the medical profession. Among the subjects not so closely related to the war are: the securing of better morbidity reports, and the question of pure water supplies for railroads. There will be reports of standing committees in regard to many of the subjects outlined above and in regard to the sanitation of public conveyances, rural sanitation, and increasing the efficiency of the conferences. The sessions will constitute the sixteenth annual conference of state and territorial health authorities with the United States Public Health Service.

THE Paris Academy of Sciences has formed a new division for applied science which is to consist of six members.

SIMMONS COLLEGE announces the graduation in May and June of specially trained women to serve as secretaries in hospitals and dispensaries, or to private physicians. Their training includes all the technical secretarial work and in addition a knowledge of medical terms, scientific German and general and special science as applied in the diagnostic laboratory.

THE American Association of Clinical Psychologists was organized at Pittsburgh on December 28, 1917. The membership includes persons holding the doctorate in psychology, who are engaged in the clinical practise of psychology in the United States. The forty-five charter members are chiefly directors of clinics, of bureaus of child welfare, of institutional laboratories; engaged in army service, as mental examiners of recruits and officers; or connected with courts, hospitals and schools. The objects of the association are to promote an *esprit de corps* among psychologists who

have entered the practical field, to provide media for the communication of ideas, to aid in establishing definite standards of professional fitness for the practise of psychology and to encourage research in problems relating to mental hygiene and corrective education.

THE biological station of the University of Michigan will hold its tenth session this summer during the eight weeks from July 1 to August 23, inclusive. This station is situated on the shores of Douglas Lake in the northern part of the southern peninsula of Michigan, about equidistant from Petoskey, Mackinaw City and Cheboygan. The personnel of the teaching staff is as follows: In zoology, George R. La Rue, of the University of Michigan, Max M. Ellis, of the University of Colorado, and Paul S. Welch, of the Kansas State Agricultural College in botany, Henry Allan Gleason and John H. Ehlers, of the University of Michigan, and Frank C. Gates, of Carthage College. Roland F. Hussey and Glenwood C. Roe will serve as assistants in zoology, and Mrs. Max M. Ellis will be dean of women. The courses offered deal with the natural history, classification and ecology of plants and animals and are of necessity given almost entirely in the field. Opportunity for investigation is offered to a limited number of investigators upon the payment of very nominal fees. For further information regarding the station and the possibilities for biological work offered there make inquiry of George R. La Rue, director, Ann Arbor, Michigan.

*The Scottish Geographical Magazine* states that a curious minor effect of the war is the possible recrudescence of indigenous malaria in England, to which attention is called in a circular issued by the Local Government Board. It is well known that anopheline mosquitoes are found in various parts of England. Numbers of men who have contracted malaria during the course of the fighting on the eastern fronts have returned home, and as their blood contains the malarial parasite, and the carriers exist in this country, these men may serve as foci of infection for the civilian population. Some cases of indigenous malaria have been already recorded in England, which probably

originated in this way, and the board is making inquiries as to the local prevalence of the carrier mosquitoes, and taking other precautions in regard to the disease.

#### UNIVERSITY AND EDUCATIONAL NEWS

THE University of Illinois college of medicine announces that, beginning with June 3, it will operate on the quadrimester system. In this system there will be three terms of four months each per calendar year. The courses will be so arranged that it will be possible for a student to enter the school at the beginning of any one of the three terms.

AFTER September of this year at Columbia University the doctorate of medicine of the medical school will be conferred only upon men who have had, in addition to four years at the medical school, one full year of service at a hospital under faculty supervision.

DR. WILLARD J. FISHER, at present honorary fellow in physics at Clark University and lecturer in physics at Worcester Polytechnic Institute, goes to Manila as assistant professor in physics at the University of the Philippines, with duties to begin about July first.

MR. KIRTLEY F. MATHER has resigned his position at Queen's University and has accepted the professorship of geology at Denison University, Granville, Ohio.

DR. FRANCIS M. VAN TUYL, assistant professor of geology and mineralogy in the Colorado School of Mines, has been promoted to an associate professorship.

DAVID D. LEIB has been promoted from associate professor to a full professor of mathematics in Connecticut College, New London.

DR. GEORGE A. BAITSELL, instructor in biology in Yale College, was appointed an assistant professor of biology at the March meeting of the Yale Corporation.

MR. WALTER S. BEACH, who will take his doctorate with his thesis in plant pathology this coming commencement, at the University of Illinois, has been appointed as instructor for plant pathological research in the Pennsylvania State College. He will have charge of a separate laboratory located near Philadelphia and is to take up his work at once.

MR. PAUL F. GAEHR, who spent the past year in research at Cornell University, will next year resume charge of the physics department at Wells College.

#### DISCUSSION AND CORRESPONDENCE PROFESSIONAL COURTESY

IN the March 8, 1918, number of *SCIENCE* there appeared from Professor McCollum and Miss Nina Simmonds a reply to Professor Hart's statement on professional courtesy in *SCIENCE*, March 1, 1918. As the former introduce a question of veracity in a statement concerning me and as they express an eagerness to be judged on "research records" I feel it my duty for the enlightenment of the public to call attention to evidence furnished by such "research records."

It is significant that the article published by Professor McCollum and Nina Simmonds as coming from the Laboratory of Agricultural Chemistry of the University of Wisconsin and to which Professor Hart referred as not indicating proper authorship, was published without the legend "Published with the permission of the Director of the Wisconsin Experiment Station." All publications coming from this station are required to have this official stamp of approval. That the authors complied with this regulation for years and violated it in this and two other recent contributions, is truly significant.

It is also significant that the said authors have not given proper credit to this institution for work done by them at Wisconsin. There has appeared in the February, 1918, number of the *Journal of Biological Chemistry* an article purporting to come as a contribution by E. V. McCollum and N. Simmonds from the Laboratory of Biochemistry of the School of Hygiene and Public Health of the Johns Hopkins University. The article was received for publication December 26, 1917, only twenty-five weeks after the authors, E. V. McCollum and N. Simmonds, had severed their official connection with the University of Wisconsin, yet in this article there were published as bona fide new contributions thirteen growth curves of rats extending over periods of twenty-eight

to forty-three weeks. One curve of growth of forty-three weeks is but a continued curve of thirty weeks stated by Professor McCollum in the *Journal of the American Medical Association* of May 12, 1917, as having been presented by him before the Harvey Society, January 13, 1917. This experiment has actually been completed at least eleven weeks before Professor McCollum left the University of Wisconsin. In fact some of the curves bear a serial number and legend the same—and none bear a higher or lower serial number—as curves of similar experiments previously published by him from this institution.

Again it is significant that Professor McCollum upon severing his relations with the University of Wisconsin removed from the campus all station records accumulated by him, and some of those of other members of the staff, without the permission or knowledge of the staff, or administrators. It is recognized that a university professor doing research work on his own initiative and on his own problems is entitled to the exclusive possession of his notes, but no such *exclusive* right is recognized in the case of experiment-station workers even to their own notes on continuing projects carried out under federal grants for an indeterminate period.

Whatever may be said in denial, these are the facts. The first two are directly supported by evidence submitted in articles published by the aforementioned authors themselves. The third, first mentioned in Professor Hart's statement, they have already not seen fit to deny.

Except for the purpose of bringing out, for the benefit of those who may be concerned in the future, not only a case of transgression of professional courtesy but of professional ethics as well, the writer is not inclined to present arguments in his own behalf, especially in a matter of such small personal moment as credit for the scientific article. For the major portion of the time while the vitamine preparations in the research in question were being made and their stability was being tested Professor McCollum did not even know what was being done, or how it was done; he fed the rats. In fact, the 1916 report of the Director of the

Wisconsin Experiment Station gives the writer of this note exclusive credit for activities in this field.

My acquaintances know full well what Professor McCollum's real personal opinion of me was before his transgressions, in an attempt to hamper further experimental work, called forth deniable but unrefutable charges. In place of a lengthy presentation of details actually called for by the indirect question aimed at my veracity and Professor Hart's veracity, but really best forgotten, there have been presented a few general facts in *final* answer instead.

H. STEENBOCK

UNIVERSITY OF WISCONSIN

TO THE EDITOR OF SCIENCE: Please accept my thanks for submitting to me the attack upon my character by Mr. Steenbock, in order that my reply may be printed together with it. I do not care to be a party to an undignified dispute over the question of the accuracy of the accusations which are contained in this letter, and shall not attempt an elaborate explanation of details. For the benefit of such readers as are not familiar with the original publications of Hart, Steenbock and myself, which will, I feel assured, suffice to prevent my colleagues in the field of biochemistry from giving any serious consideration to this matter, I shall present, briefly, a few facts which will enable them to see the matter of this controversy in its proper perspective. I shall hereafter take no notice of further utterances of this character. Any one who will take the trouble to examine the publications which have emanated from the laboratory of agricultural chemistry of the University of Wisconsin during the last ten years can easily form an opinion for himself as to who was initiating the work in nutrition investigations during that period.

When I left the University of Wisconsin in the summer of 1917, I took with me all the records of the experimental work with my rat colony but not any notes other than my own. No one who had not been closely identified with the work could possibly have correlated the many results, some of which were worthy of

publication, and others, for one reason or another, not satisfactory from which to draw conclusions. Furthermore, it will be generally conceded that no one but the experimenter himself has the right to the interpretation of his data, for he must be responsible for the correctness of such interpretation.

I find on reexamination of the charts in the paper by Miss Simmonds and myself in the *Journal of Biological Chemistry*, 1917, XXXIII., p. 303, that several of the curves of growth were secured in experiments carried out before our removal to Baltimore. I regret that mention was not made of this fact. Most of our papers contain data which was not secured from a series of experiments carried out simultaneously. The later experiments are in most cases planned in the light of the outcome of the earlier ones, the work being continued until a complete demonstration of some principle is secured. No injustice was intended or will in future be done to the University of Wisconsin by withholding proper credit for the facilities which made the work possible. The serial number of an experiment signifies the period when a certain ration was planned and entered in our notes and does not throw any light on when the feeding trial was made.

In 1907 I began to build up my rat colony at the University of Wisconsin for the purpose of studying the problem of the cause of the failure of young animals to grow when restricted to diets consisting of purified proteins, starch, sugars, fats and suitable inorganic salt mixtures. No one in this country at that time had any interest in the enterprise except myself. My first publication describing this work appeared in 1909, and antedated that of any other of similar character by two years. It required five years of fruitless experimenting before the first important observation was made which gave a clue to the solution of the problem. In 1912, Miss Davis and I first observed the peculiar growth-promoting properties of butter fat. We had a ration which we supposed consisted of food substances essentially pure, with which we could induce growth when butter fat was in-

cluded to the extent of five per cent., whereas the same food mixture containing such a fat as olive oil or lard did not induce any growth. For a time we believed that butter fat contained the only chemically unidentified dietary essential necessary for the promotion of growth or the maintenance of health in a mammal. By 1915, Miss Davis and I, after making several hundred experimental feeding trials variously modified, were forced to the conclusion that a second unknown dietary essential had been contained in the 20 per cent. of supposedly purified milk sugar, which had formed a constant constituent of many of our early diets; we thereupon propose a new working hypothesis concerning what constitutes an adequate diet. This postulates the necessity of two dietary essentials of unknown chemical nature.

After a long series of experiments planned to show the distribution of these two substances in natural food-stuffs, it was found that one of them is associated with certain fats, whereas the other is never associated with fats of either animal or vegetable origin. The latter is soluble in water, the former readily soluble in fats. Miss Kennedy and I, therefore, proposed the terms fat-soluble A and water-soluble B as provisional names pending such a time as we should learn enough about their nature to be able to give them names which would be suited to their peculiar structure, and fit in with the nomenclature of organic chemistry.

About two thousand feeding experiments have now been completed, each lasting between six weeks and two years. These were all interpreted in the light of our working hypothesis described above, and also in the light of the composition of the proteins as revealed by the studies of Fischer, Abderhalden, Osborne and others, and have made clear the nature of the dietary deficiencies of several representatives of each of the several classes of natural foods, seeds, tubers, roots, leaves, meats, eggs and milk. These results have made possible important generalizations, which must eventually lead to great improvement in the health of large groups of peoples who are now suffering

from malnutrition, due to their living on poorly constituted diets, and also to greater efficiency in the use of feeding-stuffs in animal production.

Our solution of the problem of successfully feeding diets of purified foodstuffs together with the two unidentified food essentials, fat-soluble A and water-soluble B, greatly simplified the study of the problem of isolating the latter substances. Indeed without it the study of this problem can scarcely succeed. My associates and I have further simplified the problem of their isolation by the demonstration that similar "protecting" substances do not exist for the diseases scurvy and pellagra. It had become a widely accepted belief that there existed not less than four such unknown dietary essentials, one for the prevention of beri-beri, another each for scurvy, pellagra and for rickets. This belief rested on the "vitamine" hypothesis of Funk. I need not here dwell upon the important studies of Eijkmann, Fraser and Stanton, Stepp, Holst, Funk, Williams, Osborne and Mendel, and of Goldberger, a critical study of whose papers greatly aided us in the planning of our experimental diets and in the interpretation of our results.

During my stay at the University of Wisconsin nobody had anything to do with independent work with my rat colony, except in a small way an independent study was carried on by Mr. V. E. Nelson during the months just preceding July, 1917. I reiterate my statement in my reply to Professor Hart in SCIENCE for March 8, that the work which they charged I had made dishonest use of, which was participated in by Mr. Steenbock, was planned entirely by me, and was carried out by him as directed, in the capacity of an assistant. He was not consulted about the interpretation of the data in the paper by McCollum and Simmonds (*Jour. Biol. Chem.*, January, 1917), because his personal attitude towards me before I left Wisconsin made impossible a joint preparation of the paper, and he was therefore given credit for the preparation of the materials employed in the experiments instead of being made joint author, as I should have been glad to have made him under other circumstances.

When one leaves an institution after having made observations of a fundamental character, and having for several years made use of these in the development of new and important lines of research, his colleagues who remain behind have, of course, a right to continue investigation in this field, just as any one located elsewhere has the right to take advantage of the observations of others, and attempt to further the acquisition of knowledge. There is no property right in research or its results so long as it is incomplete and not protected by patent. Some proceed on this theory, attempting the while to perfect details, and to add some element of originality, and to give their work the mark of independent thought. Others prefer to spend their time in making experiments of an exploratory character, at the risk of doing much unprofitable work in order to make some observation which will open up a new field of investigation which they may follow with profit. A few prefer to attempt to bring into disrepute some investigator who has opened up a new field of research when he has reached a point where much further work remains to be done, which is obvious to every one who studies his published results, in the hope that they may thereby so discredit him that his work will be interfered with, with a view to making possible the reaping of a harvest of opportunity which his absence from the field would make possible. Many believing that the author of the first important observation has the right to be allowed to develop the new field without annoyance, refuse, from a sense of self-respect, to pounce upon, and, in haste, complete what another is doing, when a study of fundamental nature makes possible a new type of investigation. Judgment as to which course one should pursue will, of course, be determined by the standards of the individual.

E. V. MCCOLLUM

BALTIMORE, MD.

#### THE WORLD'S CALENDAR

TO THE EDITOR OF SCIENCE: A communication by W. J. Spillman in SCIENCE of May 17 discloses the fact that a bill was introduced in the Congress on April 16 with the object of

reforming the world's calendar, by Honorable J. M. C. Smith, of Michigan.

It is gratifying to learn that the movement for Calendar Reform is thus taking on definite shape; and also that, from the writer's viewpoint, the bill referred to embodies the feature of dividing the year into thirteen lunar months, thus assigning to the moon her rightful place in determining her share of time division in the calendar.

It would appear to be sufficiently obvious without special mention, that it must be futile for any individual government to undertake a reform of the world's calendar without the co-operation of the other principal civilized nations; and that any legislation that may now be projected along that line should be with the object of securing such cooperation.

It may be suggested also that the movement might better be deferred until the present world agitation shall have subsided.

T. G. DABNEY

#### CELLULOID FOR COVER GLASSES

To THE EDITOR OF SCIENCE: War conditions are causing many substitutes to be used, and even I was forced to one by the scarcity of cover glasses for microscopic work. I found that sheet celluloid can very well be used in place of the glass, the fiber thereof being practically negligible for beginning work. I take sheet celluloid, cut strips about the width of the slide, iron these strips flat (place the heated iron over each part but do not rub, for rubbing the iron causes other streaks), and then cut the strip into small squares. In addition to being unbreakable and so quite durable and inexpensive, they can not scratch the lens by the pupil running the objective into the cover-slip, as beginners are prone to do with all cautions about such dangers forewarning them. Other science teachers may find this expedient worth trying. F. A. VARRELMAN

LOWELL HIGH SCHOOL,  
SAN FRANCISCO, CALIF.

#### AN ABSOLUTE SCALE FOR RECORDING TEMPERATURE

To THE EDITOR OF SCIENCE: I think the suggestion of Dr. Marvin in a recent number of

SCIENCE (15 March, 1918) with reference to the adoption of an approximation to the absolute scale of recording temperatures is a good one. Two suggestions occur to my mind in trying to devise an appropriate name for this scale. As it is a combination of the Absolute and the Centigrade the word "Abcent" composed of the first syllable of each word seems to give a fitting term. An alternative would be to call it the "Thomson" scale, a name which would signify that it closely resembles the Kelvin or absolute scale but is not quite the same. As is well known, Lord Kelvin's earlier name was Sir William Thomson.

J. ADAMS

CENTRAL EXPERIMENTAL FARM,  
OTTAWA, CANADA

#### SCIENTIFIC BOOKS

*Calculus.* By HERMAN W. MARCH, Ph.D., Assistant Professor of Mathematics, University of Wisconsin, and HENRY C. WOLFF, Ph.D., Assistant Professor of Mathematics, University of Wisconsin. McGraw-Hill Book Company, New York, 1917. Pp. xvi + 360.

*Differential and Integral Calculus.* By CLYDE E. LOVE, Ph.D., Assistant Professor of Mathematics, University of Michigan. The Macmillan Company, New York, 1916. Pp. xviii + 343.

*Plane Trigonometry with Tables.* By EUGENE HENRY BARKER, Head of the Department of Mathematics, Polytechnic High School, Los Angeles, California. P. Blakiston's Son and Co., Philadelphia, 1917. Pp. 172.

*College Algebra.* By ERNEST BROWN SKINNER, Assistant Professor of Mathematics, University of Wisconsin. The Macmillan Company, New York, 1917. Pp. vi + 263.

*Projective Geometry.* By L. WAYLAND DOWLING, Ph.D., Associate Professor of Mathematics, University of Wisconsin. McGraw-Hill Book Company, New York, 1917. Pp. xiii + 215.

*Elliptic Integrals.* By HARRIS HANCOCK, Professor of Mathematics in the University of Cincinnati. John Wiley and Sons, New York, 1917. Pp. 104.

Of the making of many text-books of mathematics for colleges and secondary schools there

is not only no end but no very evident diminution. The phenomenon is interesting, especially in view of the gravity of the times so unfavorable to the customary pursuits of scholars. No doubt the explanation involves a wide variety of considerations. One of these is the purely commercial competition among publishers who invite cooperation of teachers in the making of books. Another is the fact of a certain inertia acquired before the war: for example, no less than four of the above-listed volumes belong to series of publications initiated in times of peace or at all events prior to the entry of the United States into the world conflict. A third consideration relates to numbers: the number of persons in the country who are devoted to the teaching of mathematics or to mathematical research or to both is large; it is absolutely large and it is large relatively to the number of those similarly engaged a generation or two ago; the membership of the American Mathematical Society includes more than seven hundred; that of the recently organized Mathematical Association of America, more than a thousand; and there are in various sections of the country other flourishing associations of teachers of mathematics: it goes without saying that where there are many persons competent to write books many books will be written.

No doubt the more intimate personal motives to the writing of mathematical text-books are various. The hope of pecuniary reward is probably not very effective, at least not effective with many, if by hope we are to understand desire plus expectation. What may be called the reputational motive is doubtless more powerful: there is a general expectation that college and university instructors will be productive scholars; owing to a variety of circumstances the production of text-books is apt to seem an easier, albeit a less effective, way to meet such expectation than is the way of research. Then there is the altruistic motive—the impulse to serve; it is certain that this motive is frequently present and sometimes dominant: mathematical text-books are sometimes written to advance the cause of mathematical education. It is probable

that the principal motive to the kind of activity in question is really hedonic, consisting in the peculiar pleasure that is felt in trying to perform an approved task of great difficulty or—to view the matter in another aspect—in trying to win, in competition, an exceedingly difficult game. Surely there is here ample room for the play of that motive, for it is not easy to imagine an undertaking more beset with difficulties than is the writing of a mathematical text-book that is to be at once excellent in quality and successful in its appeal for public approval. The suffrages of teachers must be won. But teachers vary enormously in respect of scientific competence. The extremes are widely sundered. One of them is represented by the reactionaries, by those whose knowledge is less a knowledge of subject-matter than of traditional ways of presenting it and who are naturally opposed to every innovation of theme or of method. The other extreme is represented by the fadist, the ultra modern, the clamorous reformer whose creed is that whatever is is bad, who confuses the novel with the good, and pursues the new, because it is new, with irrational zeal. Another difficulty is the question of size: how big ought the book to be? The question is puzzling because in our schools there is no uniformity of standard or of practise regarding the amount of time devoted to a given subject. A yet more perplexing question is that of presuppositions: what degree of intellectual maturity and what degree of scientific preparation ought to be presupposed in the pupils for whom the book is designed? Such is our lack of uniformity of standards that an answer that is right for one institution or one locality will be wrong for another, and so the author is obliged to guess and to compromise. Not the least interesting part of the game, and a part that is especially fascinating, because it can never be managed quite successfully, is the part requiring the author to minister at once to the culture interests and the efficiency interests of his readers; for the two interests can not be harmonized nor made identical by the easy device of stoutly denying their difference. Again, the necessity of adjusting the

claims of the theoretician, on the one hand, and the practician, on the other, furnishes the mathematical text-book writer with a perpetually fascinating problem; for the theoretician and the practician have nothing in common save their inconsistency; in other respects they are as wide apart as the poles; the theoretician is a rigorist, a logician, a lover of the abstract, demands a minimum of assumption and a maximum of proof; the practician hates the abstract, loves the concrete, and mainly depends for his happiness on getting results by the use of rules and formulas that he neither understands nor cares to understand. To win the unqualified approval of both these types of critic is impossible, a contradiction in terms; to incur the unqualified condemnation of both is not impossible; the target to be aimed at is somewhere between; to locate it and to hit it squarely—two very different things—require a rare combination of sanity, skill and good luck.

It may be added that in these times the text-book writer receives additional stimulation from the keen competition of other subjects and from the challenge of certain cunning educators who have shrewdly discovered that the educational value of mathematics has always been greatly overestimated.

The aim of Professors March and Wolff has been to present "the calculus in such a way that it will appeal to the average student rather as a means of studying scientific problems than as a collection of proofs and formulas." The aim is commendable but in saying so we do not intend to imply, and the authors would probably not contend, that the calculus must appear either as such a "means" or as such a "collection" for it has other aspects, aspects both attractive and worthy. Integration is introduced at an early stage. In connection with the employment of infinitesimals, Duhamel's theorem is used but without too much finesse. There are numerous applications to elementary classical problems of geometry, physics and mechanics. A brief introduction to analytical geometry of three dimensions is inserted for such readers as may require it. The phrasing is in general so careful and so

good that its very excellence operates as a challenge, and one is tempted to ask whether it would not be a trifle better to say that the phrase, division by zero, is meaningless than to say (p. 30) that "division by zero is an impossible operation"; to say that the fraction,  $(x^2 - 4) : (x - 2)$ , has no value for  $x = 2$  than to say "its value is not determined at this point"; to say in such a case that there is no quotient than to say that "the quotient has no meaning." The volume closes with a very brief chapter dealing with simple types of differential equations.

To differential equations Professor Love devotes three chapters amounting to more than fifty pages. Integration is not presented earlier than page 116. This is preceded by a chapter on curve tracing. The reader is impressed with the possibility of calculating the most important mass-moments of first and second order by means of simple integration. Applications are drawn exclusively from geometry and mechanics with unusual emphasis on the latter. The importance of checking results, particularly in integration problems, is stressed. An excellent feature is the presence of "worked examples" to assist the reader in making transition from theory to practise. In Professor Love's book as in that of Professors March and Wolff the fundamental theorems respecting limits are set down without proof.

In Mr. Barker's book we have a pretty plain specimen of plane trigonometry. Trigonometric series are not present. Of the wider bearings and higher attachments of the subject the reader is not made aware. Much attention is rightly given to simple applications. The large page and open type please the eye. The punctuation is unusual and not consistent with itself. The radian is defined as if it must be conceived as always having its vertex at the center of a circle. The words "these" and "this" (pp. 2, 3) are assigned to duties that they are unable to perform. In article 4 one is at a loss to determine the significance of the repeated phrase, "said to be." The author has sometimes allowed himself the freedom of such colloquial expressions as "Expand the left members and we have" (p. 86).

Physically, mechanically and stylistically Professor Skinner's College Algebra is a tidy piece of work. It is up-to-date in its inclusions, exclusions and emphases. Its early use of geometric representation is happy. The notion of function occupies a dominant place in the entire perspective. In the definition of this notion (p. 49) the meaning of the term "known" may lead to interesting dialectic, especially if the function be implicit. Five convenient tables are inserted at the end of the volume.

Professor Dowling's "Projective Geometry" is a handsome introduction to the most exquisitely beautiful of mathematical subjects. The treatment, which is in the manner of Reye's classic "Geometrie der Lage," is synthetic as distinguished from algebraic, and presupposes no knowledge beyond ordinary elementary geometry and a very little trigonometry. It does not aim at the rigor of the postulational method, but is preliminary thereto and admirably qualifies the reader to appreciate the nature and the value of that method.

In his "Elliptic Integrals" Professor Hancock has compressed a large amount of matter into a small compass. If the work be too compact for most of those who would like to read it, the fault is not that of the author but rather that of the editors who desired him to write a work which "shall relate almost entirely to the three well-known elliptic integrals, with tables and examples showing practical applications, and which shall fill about one hundred octavo pages." This assigned task has been done faithfully, and the reader will thank the author for his full citation of the literature of the general subject.

C. J. KEYSER

COLUMBIA UNIVERSITY

SPECIAL ARTICLES  
INHERITANCE OF WINTER EGG PRODUCTION  
PRELIMINARY REPORT

*A. Progeny of a Cornish Male.*—A Cornish male was mated simultaneously to several (5) Rhode Island Red hens of high fecundity

families with a mean winter production of 52.5 eggs and to several Cornish females. The latter are poor winter layers with a mean of 8.47 eggs. There were 33 pullets from the Cornish and Rhode Island Red cross with a mean winter production of 49.2 eggs, the range being 21-86.

The offspring of this male with pure Cornish females were 11 in number and with the exception of a single individual were poor winter layers, the average of all being 11.6 eggs.

The result from the Cornish male and Rhode Island Red female cross is diametrically opposed to that obtained by Pearl from Cornish males (of the same strain that I used) bred to Barred Plymouth Rock females which are good winter layers. The offspring of this cross gave a mean winter production of 16.7 eggs. The reciprocal cross, viz., Barred Rock males and Cornish females, gave an average winter production of 30.7. We have no data at present from the corresponding cross with Rhode Island Reds. It is clear from the results of my experiment that high-producing hens are able to transmit this ability directly to her daughters, that is, high fecundity in Rhode Island Reds is not sex-linked.

*B. A Theory of the Inheritance of Winter Egg Production Alternative to Pearl's.*—It has been found that the observed ratios in which high and mediocre producers occur, both in Pearl's data on Barred Plymouth Rocks and my own with a large series of Rhode Island Reds, can be explained satisfactorily by assuming that high egg production depends upon two factors that follow the usual dihybrid Mendelian scheme. One factor alone, in either simplex or duplex condition, is assumed to give mediocre production. This theory encounters only one difficulty, viz., in a few instances there is a deficiency in the expected numbers of high producers, a result easily explicable with a physiological character such as egg production. Pearl's theory, however, encounters the reverse difficulty, *i. e.*, high producers appear where none are expected. This difficulty is explained by Pearl on the very reasonable assumption that it is due to an overlapping of phaenotypes.

There is, however, a serious difficulty with the data from both sources. This difficulty lies in the fact that the average number of daughters per mother is extremely small. The average number of daughters per mother in Pearl's experiment was 2.85, while in mine it varies from 2.6 in the early years to 6.75 in later years. Because of the small size of the families it is possible to fit any family into a place in either scheme, since the ratios expected for the various matings differ only slightly from one another. In spite of the doubt raised as to the *mode* of inheritance of winter egg production it is clear that this character is inherited, for high and low fecundity lines are readily established by suitable matings along family lines.

H. D. GOODALE

MASSACHUSETTS AGRICULTURAL  
EXPERIMENT STATION

THE AMERICAN ASSOCIATION FOR  
THE ADVANCEMENT OF  
SCIENCE  
SECTION D—ENGINEERING

THE first session was held on the morning of Friday, December 28, in Thaw Hall, University of Pittsburgh, Vice-president Dr. Henry S. Drinker in the chair, with an attendance of about thirty. It was announced that the Sectional Committee had recommended for election to the General Committee, for the office of vice-president, Dr. Ira N. Hollis, of Worcester, and for the office of secretary, Dr. Frederic L. Bishop, University of Pittsburgh. The following officers were elected by the Section:

*Member of Council*—Dr. George F. Swain, of Harvard University and the Massachusetts Institute of Technology.

*Member of General Committee*—Charles Henry Davis, of Cambridge, Mass.

*Member of Sectional Committee*—William Bowie, of Washington, D. C.

The program of the session was as follows:

*Railroad track, its defects and abuses, and their amelioration*: G. H. BARBOUR. *Historical*: The age of the drawn and that of the driven wheel; ancient English tramways; the institution of that distinctively American principle now governing the construction of railroad

track as now practised by all the steamroads in the world, wherein the equipment upon its track constitutes a flexible superstructure upon an elastic roadbed. *Defects*: Weak rails; narrow railheads; excessive deflections; joints. *Abuses*: Worn and ragged wheels; improper wheel spacing; dynamic augments; lateral thrusts. *Amelioration*: Increased bearing on ballast; decreased depth of ballast; augmentation of rail; increased lateral strength; broader head; more frequent lateral fastenings; maintaining height of rail at the minimum.

*The scientific principles of building codes*: J. A. FERGUSON. A good building code occupies a very responsible position among the vital issues of municipal welfare. Properly planned, a building code should insure safety to life, limb, health and property, and should function to minimize loss or injury to either. Progress in the arts has introduced many new factors in the occupation of buildings, which necessitate the scientific handling and classification of the requirements and progress in building has made it possible to classify the various forms of building construction into distinct groups. The same progress has made it possible to classify occupancies and construction of buildings and to specify the minimum allowable construction for the various occupancies. This it is now proposed to do in one notable case for the city of Pittsburgh, Pa. Other phases of this subject are susceptible of scientific definition, and in order to properly regulate buildings it is becoming increasingly necessary to classify and define in a scientific manner all subjects. The paper gives typical arrangement for a code and explains the reasoning upon which it is based as well as for the classification of other regulatory provisions in a good building code.

*Relative efficiency of different methods of repairing bituminous macadam and bituminous concrete pavements*: GEORGE H. BILES. The bituminous macadam and bituminous concrete pavements in their various stages of disrepair offer excellent opportunity to the highway engineer for study and experiment. The methods of repairs to pavements of these types have advanced to such a degree in recent years that there are innumerable instances where pavements have been reclaimed by scientific analysis of the causes of deterioration and by efficient application of the principles of repair applicable to each case. Central bituminous mixing plants are advisable where the amount of yardage and its accessibility warrant as in cases of municipalities. In most other cases,

general repairs can be made successfully with cold bituminous preparations.

*The efficiency of the application of cold bituminous materials for surface treatments on gravel and broken stone roads:* JULIUS ADLER. In the development of bituminous surface treatment practise during the past ten years, the most important step forward has been the recognition of the fundamental necessity of a road well built in every respect, and having a mosaic surface especially adapted to receive the bituminous material. In the selection of the latter, a greater and desirable degree of uniformity of practise will follow upon a clear understanding of the characteristics which identify them as most suitable to serve the two functions of: (a) Priming; (b) smoothing and rendering impervious the road surface. The precise limits of suitability of bituminous-treated roads can hardly be determined definitely in traffic units because of the difference in materials in use, and combined traffic and climatic conditions. From an economical standpoint, they represent a high annual maintenance charge which is an argument in favor of their use in the preservation of existing roads, rather than in a program of new construction. The full possibilities in their use, however, will not be realized until high-grade original construction, scientific selection of materials and systematic maintenance are all combined.

*Present status of granite block pavements:* C. D. POLLOCK. This paper describes the improvement of the granite block pavement from its early form to the latest types of smooth surface, close jointed pavements. The latest and best joint fillers are shown and likewise the various cushions or beds for the blocks. The great improvements which have been brought about in making granite blocks and also in laying this pavement, in recent years, are due entirely to the cooperation between the engineers and the quarrymen. The engineers learned enough of quarrying to draw specifications calling for the best practicable block and the quarrymen have exerted themselves to make that block.

*Rattler tests for paving brick of various depths:* WILLIAM C. PERKINS. Discussion of the rattler used for testing paving brick and a short history of same. The testing of paving brick of different depth and the theoretical determination of an allowance or differential for same. Discussion of a modification of the abrasive charge in rattler in the testing of paving brick.

*Motor trucks and long distance highway transportation:* MAURICE B. GREENOUGH. Statistics

show that the railroads have nearly if not quite reached the limit of their capacity for freight hauling. At the same time there is a growing shortage of cars. They themselves have advocated the use of motor trucks on the public highways for short hauls to relieve congestion. Increased highway construction and organized effort to encourage the use of highways are essential to make the potential relief an actuality.

*The construction and maintenance of highways under war conditions:* ARTHUR H. BLANCHARD. Since the United States entered the war, motor truck transportation on country highways has rapidly developed due to the following causes: First, the marked increase in the tonnage and bulk of shipments; second, the lack of railroad equipment to efficiently handle freight and express transportation; third, the inadequacy of railroad terminal facilities; fourth, the United States government priority orders; and fifth, the intensified consideration of economic problems, the solution of which would lower prices of the necessities of life. Suggestions relative to construction and maintenance of highways under war conditions: (1) Maximum use of motor truck transportation of materials and machinery; (2) amendment of onerous traffic regulations which prevent economic use of motor trucks; (3) modification of state laws to permit construction and maintenance of highways by day labor; (4) award of contracts to responsible contractors on a cost plus a profit on labor and rental of equipment, all materials being furnished by the state or county; (5) modification of contracts and specifications which place all liabilities on contractors; (6) maximum use of labor-saving machinery; (7) maximum utilization of convicts and prisoners of war; (8) construction and maintenance of military highways by the United States government.

The second session was held on the afternoon of December 28 in the Lecture Hall of the Mellon Institute, Vice-president Dr. Henry S. Drinker in the chair, with an attendance of about one hundred ten. This meeting was a joint session with Section C; Society for the Promotion of Engineering Education; Engineer's Society of Western Pennsylvania; Pittsburgh Section, American Electro-Chemical Society, and the Pittsburgh Section, American Chemical Society. The program of the session was as follows:

*Vice-presidential address, some needs of engineering:* DR. HENRY M. HOWE. Printed in the issue of SCIENCE for January 25.

*Mechanical manufacture of window glass:* DR. F. L. BISHOP.

*A manufacturer's experience with graduate chemical engineers:* S. R. CHURCH. Two years' experience with about one hundred graduate chemical engineers has suggested the following apparent deficiencies in training seemingly common to men from a large number of colleges:

1. Lack of judgment necessary to weigh correctly
  - (a) the value or limitations of test data;
  - (b) the degree of accuracy required;
  - (c) the occasion for choosing quantitative or qualitative methods of analysis.
2. Lack of sufficient imagination to grasp the indicated possibilities for further work pointed out by experiments themselves partial or complete failures.
3. Lack of ability to write a report sufficiently well ordered and comprehensive to do justice to the merits of the work accomplished.

The writer favors the five- or six-year course for chemical engineers but urges that especially in abbreviated courses the student be given a better practical sense of commercial values.

*A survey of high-school chemistry in Pennsylvania:* ALEXANDER SILVERMAN. The report includes graphs and tabulated answers on college preparatory chemistry from 126 of 971 schools receiving information blanks. Answers cover length of course, when given, whether preceded or followed by physics, number of lecture periods per week, recitation periods, length and number of laboratory periods, number of sections of each and number of pupils per section, text-books employed, laboratory manuals employed, elements omitted, theories, laws and principles omitted. Also information about general science and other chemistry courses given, number of subjects taught by instructors together with number of hours of lecture, recitation and laboratory practise conducted. Further, the training received in preparation for teaching. The great lack of uniformity already observed leads the author to recommend standardization by a state commission, or preferably by the United States Commissioner of Education, with power to enforce standards so that colleges and universities may begin their work where the high schools end, thus avoiding duplication.

The following resolution was unanimously adopted:

*Resolved,* That the thanks of the Joint Conference be extended to the *New York World*, the *New York Times* and the *Jeweler's Circular* for co-operating with the chemists of the United States

in the conservation of platinum by excluding the word platinum from their advertising columns.

The third session was held on the morning of Saturday, December 29, in the Applied Science Building of the Carnegie Institute of Technology, Vice-president Dr. Henry S. Drinker in the chair, with an attendance of about forty-five. The program of the session was as follows:

*Solution of spherical triangles by diagrams:* HORACE R. THAYER. All spherical triangles may be solved by the use of two simple formulæ. If now these be accurately computed and plotted, they may be employed to solve many cases which occur in practise with a minimum of cost, at the same time lessening the danger of serious error.

*Conservation of fuel through smoke regulation:* J. W. HENDERSON. Conservation that merely contemplates withholding the natural resources from use, keeping them in their natural state, can hardly be considered conservation in its broadest application. The logical starting point is that of "taking stock" of the natural resources. Having this knowledge, conservation can be carried on, on the basis of "the application of common sense to common problems for the common good." The needless waste of fuel and of recoverable by-products, in this country, has been conservatively estimated at one billion (\$1,000,000,000) dollars annually. Investigations and experience demonstrate that the production and emission from stacks, of smoke prohibited by law, means waste—direct waste of combustible materials and their by-products and contributory, contingent waste of building materials, household goods, vegetation and of human energy, both physical and mental. In a few cases smoke regulation is under state control. Many foreign countries have placed it within the activities of their central governing powers. The work in Pittsburgh has proved that smoke regulation is a fuel conservation problem. Smoke means waste. Proper smoke regulation results in saving fuels. Conservation as proposed will induce complete combustion of them and stop the production of smoke. Smoke regulation is so closely related to conservation as to indicate the necessity of the government adopting it in its program of conservation. The work can not be of a constructive and permanent character if left to the fluctuating political activities of the cities, counties or states. The way to meet the requirements is to not make the smoke. This is accomplished by securing more perfect combustion. The subject deserves the attention of scientists and of practical engineers and of every thinking man and woman.

who appreciates that there is an "inalienable right to life, liberty and the pursuit of happiness." Smoke regulation of the character indicated should be country-wide.

*Modern tendency in locomotive design:* L. E. ENDSLEY. The locomotive of to-day is being scientifically designed and constructed in order to produce as efficient and powerful a locomotive as possible with the minimum of weight. Special grades of steel are used and some parts are being heat-treated in order to get a stronger part of less weight. To-day a horsepower is being developed in the modern locomotive with thirty per cent. less coal than that fifteen years ago. This has all been brought about by the addition of superheaters, brick arch, stoker, etc.

*Measuring telephone transmission:* R. L. SNYDER. Brief review of the advance made in the art of measuring transmission over telephone lines. Notation of the characteristics of circuits which cause losses in telephone transmission. Pointing out that savings are accomplished by the advance in the art of calculating and measuring telephone transmission.

*Industrial housing and town planning:* GEORGE W. CASE. Many of the industrial towns being built in America are laid out according to the Garden City idea, a method of city planning which originated in England. A Garden City plan is one in which sufficient ground is devoted to each house to provide, in addition to plenty of light and air, a garden for every family. The streets are generally laid out to curve with the contours, to reduce the amount of grading and allow the placing of houses to obtain the best architectural effects. Parks and playgrounds provide places for recreation and proper restrictions insure permanent homes. Under an enabling act of 1890 the British government lends money on long-term bonds, to be used in building houses for working people, on tracts laid out in the above manner. We need such a law, in this country, to properly develop the boundaries of our industrial cities, so they will not become slum areas and also to build permanent houses for our working people, in well-laid-out tracts, and finance them so that the payments can be made to fit the income of the wage-earner. The high labor turn-over, being experienced in our industries at the present time, is receiving much attention from employers, and those who are building houses, of the right sort, report substantial successes in stabilizing their labor forces by this means.

*The electrical safety work of the Bureau of Standards:* M. G. LLOYD. A study of the accident hazards connected with electrical work led the Bureau of Standards to formulate a set of rules for the construction and operation of electrical equipment which is known as the National Electrical Safety Code. These rules were published over a year ago after many tentative drafts had been criticized and revised by conferees representing the various utilities, inspection interests and state commissions interested in and affected by the rules. The Code has been cordially received and is receiving general application on trial with tentative and in some cases formal adoption by federal, state, municipal authorities and private bodies.

*Higher harmonics of polyphase electrical systems:* V. KARAPETOFF. Higher harmonics in a symmetrical  $n$ -phase system are considered for both the star and the mesh connection. It is shown which harmonics can not exist in the mesh voltage although present in the star voltages, and which harmonics give rise to circulating currents in a mesh. The phenomenon of oscillating neutral is explained and the effect of secondary mesh currents in furnishing transformer magnetizing currents is discussed. Polyphase magnetomotive forces are treated in the most general case when harmonics are present both in time and in space. Formulæ are given for the order of harmonics which produce gliding and pulsating M.M.F.'s.

*Mineral composition of refractory silica brick:* J. S. McDOWELL. Of the minerals tridymite, cristobalite and quartz constituting silica brick, tridymite has the lowest thermal expansion. An all-tridymite brick would, therefore, have the lowest spalling tendency. Microscopic analyses of brick burned from one to ten times show that at the slow rate of inversion of the quartz to tridymite, an all-tridymite brick would not be commercially practical. Analyses of two bricks, one made of Baraboo and the other of Medina quartzite, illustrate the greater rapidity of the inversions of quartz to cristobalite and tridymite with the finer textured Medina rock.

*Why dams fail:* EDWARD GODFREY. History of under pressure as an idea in the professional mind. Present status of the idea of under pressure. Loss of weight of dams and submerged piers discussed and compared. Tests of under pressure. Explanations of the failure of dams. The kind of masonry dams that fail. Inefficiency of some attempts at prevention of failure by uplift.

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